pg. 41

Please replace the paragraph starting on page ~~40~~, line ~~11~~, with the following paragraph, which is presented in marked-up form in the attached appendix:

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An interface apparatus providing two linear (X and Y) degrees of freedom to user object 34 as well as a rotating ("spin") third degree of freedom about a Z axis is quite suitable for the paddle-ball implementation. Linear degree of freedom apparatuses are disclosed in Patent Nos. 5,721,566 and 5,805,140, previously incorporated herein, and further embodiments of such are described below.

<u>IN THE CLAIMS:</u>

Please amend the claims as follows. Marked-up copies of the amended claims are presented in the attached appendix.

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77. (Amended) Processor-executable code, comprising:

code to determine a trajectory of a first simulated object, the trajectory associated with a prior position of the first object, simulated motion of the first simulated object being associated with motion of a physical object of a computer interface device;

code to simulate a second simulated object configured to impede the simulated motion of the first simulated object when the trajectory of the first simulated object intersects the second simulated object;

code to display a simulated interaction between the first simulated object and the second simulated object; and

code to provide a force feedback via a force feedback mechanism, the force feedback being associated with the simulated interaction of the first simulated object with the second simulated object.

78. (Amended) The processor-executable code of claim 77, wherein the code to provide a force feedback includes code to provide a restoring force that is proportional to a magnitude of a simulated penetration of the first simulated object and the second simulated object.

79. (Amended) The processor-executable code of claim 78, wherein the restoring force includes a spring force having the mathematical form:

$$F = kx$$

where F is the restoring force, x is a magnitude of a deviation of the spatial correlation including a deviation between the current location of the first simulated object and a location of the first simulated object had the simulated penetration occurred and k is a spring constant parameter.

80. (Amended) The processor-executable code of claim 79, wherein the restoring force includes a damping force and the restoring force has the mathematical form:

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cont

$$F = kx + bv$$

where F is the restoring force, x is a magnitude of a deviation of the spatial correspondence including a deviation between the current location of the first simulated object and a location of the first simulated object had the simulated penetration occurred, v is a function of a velocity of the physical object, and k and b are constant parameters.

81. (Amended) The processor-executable code of claim 80, wherein the restoring force includes an inertial force corresponding to movement of the second simulated object in response to the simulated interaction between the second simulated object and the first simulated object and the restoring force has the mathematical form:

$$F = kx + bv + ma$$

where F is the restoring force, x is a magnitude of a deviation of the spatial correspondence including a deviation between the current location of the first simulated object and a location of the first simulated object had the simulated penetration occurred, v is a function of a velocity of the physical object, a is a function of an acceleration of the physical object, and k, b and m are constant parameters.

82. (Amended) The processor-executable code of claim 78, wherein the code to provide the restoring force includes a component associated with friction between the first simulated object and a simulated spatial environment.

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83. (Amended) The processor-executable code of claim 77, wherein the code to simulate the second simulated object is associated with motion of a second physical object of a second computer interface device.

84. (Amended) The processor-executable code of claim 78, wherein the code to provide the restoring force includes a weighting factor such that a simulated location L of the first and second simulated objects is output on a display, the location L being determined by the equation:

$$L = \frac{(w_1 x_1 + w_2 x_2)}{(w_1 + w_2)}.$$

85. (Amended) The processor-executable code of claim 77, the interface device being a first interface device wherein the code to simulate the motion of the first simulated object is associated with a first processor, and the code to simulate the second object is associated with a second processor the second processor being associated with input from a second interface device, the first processor and the second processor being coupled such that input signals from the first interface device are associated with input signals from the second interface device.

86. (Amended) A method, comprising:

updating data values associated with a first graphical object based on movement of at least a portion of a force feedback device;

determining whether the first graphical object has engaged a second graphical object based on a path of the first graphical object associated with a prior position of the first graphical object;

displaying in a graphical environment the first graphical object as remaining engaged with the second graphical object if it is determined that the path of the first graphical object passes through the second graphical object; and

outputting a force feedback signal to at least one actuator of the force feedback device, the force feedback signal being operative to output an opposing force on at least a portion of the force feedback device in a direction approximately opposite to the path of the first graphical object while the first graphical object engages the second graphical object.

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87. (Amended) The method of claim 86, wherein the opposing force is a restoring spring force.

88. (Amended) The method of claim 86, wherein at least a portion of the second graphical object is fixed in location within the graphical environment.

89. (Amended) The method of claim 86, the force feedback device being a first force feedback device, the method further comprising:

updating data values associated with the second graphical object based on movement of at least a portion of a second force feedback device.

90. (Amended) The method of claim 89, wherein the first force feedback device is coupled to a first host computer, and the second force feedback device is coupled to a second host computer, the second host computer being coupled to the first host computer via a network connection.

Please add the following new claims:

98. (New) The processor executable code of claim 83, wherein the first computer interface device is configured to be coupled to a first computer, and the second computer interface device is configured to be coupled to a second computer, the second computer configured to communicate with the first computer.

99. (New) A processor readable medium having processor-executable code stored thereon, the code to:

determine a trajectory of a first simulated object, the trajectory associated with a prior position of the first simulated object, simulated motion of the first simulated object being associated with motion of a physical object of a computer interface device;

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simulate a second simulated object configured to impede the simulated motion of the first simulated object when the trajectory of the first simulated object intersects the second simulated object;

display a simulated interaction between the first simulated object and the second simulated object; and

provide a force feedback via a force feedback mechanism, the force feedback being associated with the simulated interaction of the first simulated object with the second simulated object.

100. (New) The processor-readable medium of claim 99, wherein the code to provide a force feedback includes code to provide a restoring force that is proportional to a magnitude of a simulated penetration of the first simulated object and the second simulated object.

101. (New) The processor-readable medium of claim 100, wherein the restoring force includes a spring force having the mathematical form:

$F = kx$

where F is the restoring force, x is a magnitude of a deviation of the spatial correlation including a deviation between the current location of the first simulated object and a location of the first simulated object had the simulated penetration occurred and k is a spring constant parameter.

102. (New) The processor-readable medium of claim 101, wherein the restoring force includes a damping force and the restoring force has the mathematical form:

$$F = kx + bv$$

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where F is the restoring force, x is a magnitude of a deviation of the spatial correspondence including a deviation between the current location of the first simulated object and a location of the first simulated object had the simulated penetration occurred, v is a function of a velocity of the physical object, and k and b are constant parameters.

103. (New) The processor-readable medium of claim 102, wherein the restoring force includes an inertial force corresponding to movement of the second simulated object in response to the simulated interaction between the second simulated object and the first simulated object and the restoring force has the mathematical form:

$$F = kx + bv + ma$$

where F is the restoring force, x is a magnitude of a deviation of the spatial correspondence including a deviation between the current location of the first simulated object and a location of the first simulated object had the simulated penetration occurred, v is a function of a velocity of the physical object, a is a function of an acceleration of the physical object, and k, b and m are constant parameters.

104. (New) The processor-readable medium of claim 100, wherein the code to provide the restoring force includes a component associated with friction between the first simulated object and a simulated spatial environment.

105. (New) The processor-readable medium of claim 99, wherein the code to simulate the second simulated object is associated with motion of a second physical object of a second computer interface device.

106. (New) The processor-readable medium of claim 100, wherein the code to provide the restoring force includes a weighting factor such that a simulated location L of the first and second simulated objects is output on a display, the location L being determined by the equation:

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$$L = \frac{(w_1 x_1 + w_2 x_2)}{(w_1 + w_2)}.$$

107. (New) The processor-readable medium of claim 99, the interface device being a first interface device wherein the code to simulate the motion of the first simulated object is associated with a first processor, and the code to simulate the second object is associated with a second processor the second processor being associated with input from a second interface device, the first processor and the second processor being coupled such that input signals from the first interface device are associated with input signals from the second interface device.

REMARKS

Entry of the foregoing amendments, and reconsideration of the application in light of the amendments above and the remarks that follow is respectfully requested. Claims 77-107 are currently pending in the application.

Applicants gratefully acknowledge the Examiner's indication, on page 7 of the Office Action, that claims 94-96 have been allowed, and that claims 83 and 85 contain allowable subject matter.